

### EFFECTS OF COMPOSITION ON PHYSICAL PROPERTIES OF SPI<sup>1</sup>/PVA<sup>2</sup>/PVP<sup>3</sup> FOAM SHEETS<sup>4</sup>

SAMPLE	PVA/PVP (PARTS)	DENSITY (g/cc)	TENSILE STRENGTH (MPa) <sup>5</sup>	ELONGATION (AT BREAK, %) <sup>5</sup>	YOUNG'S MODULUS (MPa) <sup>5</sup>
1	0/0	0.53	6.47 ± 0.56	7.67 ± 1.61	164.90 ± 49.60
2	2/0	0.61	4.70 ± 0.37	23.39 ± 5.09	125.30 ± 33.33
3	3/0	0.47	5.72 ± 0.55	28.13 ± 12.05	153.00 ± 33.43
4	2/2	0.47	7.61 ± 0.64	8.48 ± 0.82	178.70 ± 25.40
5	10/3	0.52	6.95 ± 0.75	15.22 ± 3.46	161.00 ± 24.20

<sup>1</sup>SPI: SOY PROTEIN ISOLATE

<sup>2</sup>PVA: POLY(VINYL ALCOHOL)

<sup>3</sup>PVP: POLY(VINYL PYRROLIDONE)

<sup>4</sup>FORMULATION: 100 PARTS SPI, 80 PARTS WATER, 25 PARTS GLYCEROL, AND 1 PART SODIUM TRIPOLYPHOSPHATE, (ALL BASED ON 100 PARTS DRY WEIGHT SOY PROTEIN)

<sup>5</sup>MEAN ± STANDARD DEVIATION.

*Fig. 1*

### EFFECTS OF PVA CONCENTRATION ON PHYSICAL PROPERTIES OF SPI<sup>1</sup>/PVA<sup>2</sup>/PVP<sup>3</sup> FOAM SHEETS<sup>4</sup>

SAMPLE	PVA/PVP (PARTS)	DENSITY (g/cc)	TENSILE STRENGTH (MPa) <sup>5</sup>	ELONGATION (AT BREAK, %) <sup>5</sup>	YOUNG'S MODULUS (MPa) <sup>5</sup>
1	0	0.45	4.96 ± 0.88	3.69 ± 0.75	205.7 ± 38.2
2	10/2	0.54	6.40 ± 0.68	4.2 ± 0.56	243.6 ± 38.7
3	20/2	0.56	7.54 ± 0.82	9.17 ± 2.86	257.7 ± 51.10
4	30/2	0.52	7.65 ± 0.68	6.72 ± 1.55	266.4 ± 27.4
5	40/2	0.53	8.04 ± 0.48	11.61 ± 3.08	281.1 ± 27.9

<sup>1</sup>SPI: SOY PROTEIN ISOLATE

<sup>2</sup>PVA: POLY(VINYL ALCOHOL)

<sup>3</sup>PVP: POLY(VINYL PYRROLIDONE)

<sup>4</sup>FORMULATION: 100 PARTS SPI, 80 PARTS WATER, 20 PARTS GLYCEROL, 0.5 PARTS POTASSIUM SORBATE (PRESERVATIVE), AND 1 PART SODIUM TRIPOLYPHOSPHATE, (ALL BASED ON 100 PARTS DRY WEIGHT SOY PROTEIN)

<sup>5</sup>MEAN ± STANDARD DEVIATION.

*Fig. 2*

202209492660

### EFFECTS OF OCTENYDECENE SUCCINIC ANHYDRIDE ON PHYSICAL PROPERTIES OF SPI<sup>1</sup>/PVA<sup>2</sup>/PVP<sup>3</sup> FOAM SHEETS<sup>4</sup>

SAMPLE	PVA/PVP	ODSA <sup>5</sup>	DENSITY (g/cc)	TENSILE STRENGTH (MPa) <sup>6</sup>	ELONGATION (AT BREAK, %) <sup>6</sup>	YOUNG'S MODULUS (MPa) <sup>6</sup>
1	0	0	0.50	6.30 ± 4.02	4.02 ± 0.61	193.7 ± 25.4
2	10/2	2	0.51	6.21 ± 0.61	5.28 ± 0.35	141.2 ± 35.5
3	20/2	2	0.55	6.52 ± 0.51	12.93 ± 3.09	190.5 ± 52.40
4	30/2	2	0.52	6.61 ± 0.40	14.15 ± 3.10	151.0 ± 20.4
5	40/2	2	0.45	6.43 ± 0.53	11.39 ± 2.68	170.10 ± 34.57

<sup>1</sup>SPI: SOY PROTEIN ISOLATE

<sup>2</sup>PVA: POLY(VINYL ALCOHOL)

<sup>3</sup>PVP: POLY(VINYL PYRROLIDONE)

<sup>4</sup>FORMULATION: 100 PARTS SPI, 80 PARTS WATER, 20 PARTS GLYCEROL, 0.5 PARTS POTASSIUM SORBATE (PRESERVATIVE), AND 1 PART SODIUM TRIPOLYPHOSPHATE, (ALL BASED ON 100 PARTS DRY WEIGHT SOY PROTEIN)

<sup>5</sup>ODSA: OCTENYDECENE SUCCINIC ANHYDRIDE

<sup>6</sup>MEAN ± STANDARD DEVIATION.

*Fig. 3*

### EFFECTS OF GLYCEROL CONCENTRATION ON PHYSICAL PROPERTIES OF SPI<sup>1</sup>/PVA<sup>2</sup>/PVP<sup>3</sup> FOAM SHEETS<sup>4</sup>

GLYCEROL (PARTS)	PVA/PVP	DENSITY (g/cc)	TENSILE STRENGTH (MPa)	ELONGATION (AT BREAK, %)	YOUNG'S MODULUS (MPa)
BLANK	0/0	0.46	5.86 ± 0.38	11.54 ± 2.41	158.8 ± 39.6
20	10/3	0.44	6.57 ± 0.55	16.33 ± 0.60	162.7 ± 33.4
25	10/3	0.47	4.89 ± 0.33	37.75 ± 5.08	125.2 ± 26.6
30	10/3	0.47	3.96 ± 0.24	65.52 ± 2.42	90.62 ± 15.12

<sup>1</sup>SPI: SOY PROTEIN ISOLATE

<sup>2</sup>PVA: POLY(VINYL ALCOHOL)

<sup>3</sup>PVP: POLY(VINYL PYRROLIDONE)

<sup>4</sup>FORMULATION: 100 PARTS SPI, 80 PARTS WATER, 1 PART SODIUM TRIPOLYPHOSPHATE, (ALL BASED ON 100 PARTS DRY WEIGHT SOY PROTEIN). BLANKS CONTIAN 20 PARTS GLYCEROL.

<sup>5</sup>MEAN ± STANDARD DEVIATION.

*Fig. 4*

APPROVED	C	FIG.
BY	CLASS	SUBCLASS
DRAFTSMAN		

EFFECTS OF GELATIN ON THE PHYSICAL PROPERTIES OF SPI<sup>1</sup>/PVA<sup>2</sup>/PVP<sup>3</sup> FOAM SHEETS<sup>4</sup>

SAMPLE	PVA/PVP (PARTS)	GELATIN (PARTS)	DENSITY (g/cc)	TENSILE STRENGTH (MPa)	ELONGATION (AT BREAK, %)	YOUNG'S MODULUS (MPa)
1	0	0	0.46	5.86 ± 0.38	11.54 ± 2.41	158.8 ± 39.6
2	10/3	0	0.44	6.57 ± 0.55	16.33 ± 0.60	162.7 ± 33.4
3	10/3	6	0.43	7.11 ± 0.48	14.42 ± 1.48	170.8 ± 37.8
4	10/3	10	0.52	7.47 ± 0.30	18.81 ± 6.06	162.5 ± 16.2

<sup>1</sup>SPI: SOY PROTEIN ISOLATE

<sup>2</sup>PVA: POLY(VINYL ALCOHOL)

<sup>3</sup>PVP: POLY(VINYL PYRROLIDONE)

<sup>4</sup>FORMULATION: 100 PARTS SPI, 80 PARTS WATER, 20 PARTS GLYCEROL, 0.5 PARTS POTASSIUM SORBATE (PRESERVATIVE), AND 1 PART SODIUM TRIPOLYPHOSPHATE, (ALL BASED ON 100 PARTS DRY WEIGHT SOY PROTEIN)

<sup>5</sup>MEAN ± STANDARD DEVIATION.

*Fig. 5*

# EFFECTS OF PROCESSING AIDES ON PHYSICAL PROPERTIES OF SPI<sup>1</sup>/PVA<sup>2</sup>/PVP<sup>3</sup> FOAM SHEETS<sup>4</sup>

SAMPLE (0.5 PARTS)	PVA/PVP	DENSITY (g/cc)	TENSILE STRENGTH (MPa)	ELONGATION (AT BREAK, %)	YOUNG'S MODULUS (MPa)
BLANK	0	0.44	2.96 ± 0.20	42.20 ± 5.84	56.37 ± 8.65
NaCl <sup>6</sup>	2/1	0.49	3.63 ± 0.32	52.48 ± 12.76	91.84 ± 17.62
Na <sub>2</sub> SO <sub>3</sub> <sup>6</sup>	2/1	0.51	3.50 ± 0.36	60.88 ± 6.25	76.18 ± 11.37
CaSt <sup>6</sup>	2/1	0.63	3.88 ± 0.28	56.80 ± 9.58	86.77 ± 35.12
ZnSt <sup>6</sup>	2/1	0.59	3.35 ± 0.07	48.59 ± 7.81	68.11 ± 9.32
SDS <sup>6</sup>	2/1	0.53	3.57 ± 0.34	62.00 ± 7.88	104.60 ± 26.54
UNIFLEX <sup>6</sup>	2/1	0.60	3.06 ± 0.16	50.22 ± 2.99	73.49 ± 23.88
Int-38H <sup>6</sup>	2/1	0.56	3.24 ± 0.40	50.42 ± 8.22	85.43 ± 25.50
Int66HS <sup>6</sup>	2/1	0.61	3.95 ± 0.27	57.64 ± 6.79	88.11 ± 15.80

<sup>1</sup>SPI: SOY PROTEIN ISOLATE

<sup>2</sup>PVA: POLY(VINYL ALCOHOL)

<sup>3</sup>PVP: POLY(VINYL PYRROLIDONE)

<sup>4</sup>FORMULATION: 100 PARTS SPI, 80 PARTS WATER, 20 PARTS GLYCEROL, 0.5 PARTS POTASSIUM SORBATE (PRESERVATIVE), AND 1 PART SODIUM TRIPOLYPHOSPHATE, (ALL BASED ON 100 PARTS DRY WEIGHT SOY PROTEIN)

<sup>5</sup>MEAN ± STANDARD DEVIATION.

<sup>6</sup>NaCl= SODIUM CHLORIDE, Na<sub>2</sub>SO<sub>3</sub>= SODIUM SULFITE, CaSt= CALCIUM STEARATE, ZnSt= ZINC STEARATE  
SDS= SODIUM DODECYL SULFATE, UNIFLEX= COMMERCIAL LUBRICANT FROM UNION CAMP COMPANY,  
INT-38H= INTERNAL LUBRICANT FROM AXEL COMPANY, INT-66HS= INTERNAL LUBRICANT  
FROM AXEL COMPANY

*Fig. 6*

00076346 042660

# EFFECTS OF FLAVORING AGENTS ON PHYSICAL PROPERTIES OF SPI<sup>1</sup>/PVA<sup>2</sup>/PVP<sup>3</sup> FOAM SHEETS<sup>4</sup>

SAMPLE	FLAVORING AGENT	PVA/PVP	DENSITY (g/cc)	TENSILE STRENGTH (MPa)	ELONGATION (AT BREAK, %)	YOUNG'S MODULUS (MPa)
1	0	3/2	0.42	5.45 ± 0.80	10.54 ± 2.47	172.40 ± 31.6
2	0	3/2	0.47	5.72 ± 0.55	28.13 ± 12.05	153.00 ± 33.43
3	LEMON	3/2	0.39	4.92 ± 0.83	10.97 ± 1.39	136.10 ± 19.63
4	ALMOND	3/2	0.38	5.18 ± 0.95	13.31 ± 1.90	137.20 ± 24.81

<sup>1</sup>SPI: SOY PROTEIN ISOLATE

<sup>2</sup>PVA: POLY(VINYL ALCOHOL)

<sup>3</sup>PVP: POLY(VINYL PYRROLIDONE)

<sup>4</sup>FORMULATION: 100 PARTS SPI, 80 PARTS WATER, 20 PARTS GLYCEROL, 0.5 PARTS POTASSIUM SORBATE (PRESERVATIVE), AND 1 PART SODIUM TRIPOLYPHOSPHATE, (ALL BASED ON 100 PARTS DRY WEIGHT SOY PROTEIN)

<sup>5</sup>MEAN ± STANDARD DEVIATION.

LEMON AND ALMOND FLAVORING AGENTS= 1 PART EACH

*Fig. 7*

# EFFECTS OF COLORANTS ON PHYSICAL PROPERTIES OF SPI<sup>1</sup>/PVA<sup>2</sup>/PVP<sup>3</sup> FOAM SHEETS<sup>4</sup>

SAMPLE	COLORANT	PVA/PVP	DENSITY (g/cc)	TENSILE STRENGTH (MPa)	ELONGATION (AT BREAK, %) <sup>5</sup>	YOUNG'S MODULUS (MPa)
1	0	0/0	0.42	5.45 ± 0.80	10.54 ± 2.47	172.40 ± 31.6
2	10/3	3/2	0.47	5.72 ± 0.55	28.13 ± 12.05	153.00 ± 33.43
3	PHthalocyanine <sup>6</sup>	3/2	0.59	4.30 ± 0.45	20.84 ± 5.0	111.30 ± 25.50
4	PHthalocyanine GREEN <sup>7</sup>	3/2	0.59	4.47 ± 0.33	23.06 ± 12.37	128.80 ± 20.54

<sup>1</sup>SPI: SOY PROTEIN ISOLATE

<sup>2</sup>PVA: POLY(VINYL ALCOHOL)

<sup>3</sup>PVP: POLY(VINYL PYRROLIDONE)

<sup>4</sup>FORMULATION: 100 PARTS SPI, 80 PARTS WATER, 20 PARTS GLYCEROL, 0.5 PARTS POTASSIUM SORBATE (PRESERVATIVE), AND 1 PART SODIUM TRIPOLYPHOSPHATE, (ALL BASED ON 100 PARTS DRY WEIGHT SOY PROTEIN)

<sup>5</sup>MEAN ± STANDARD DEVIATION.

<sup>6</sup>PHthalocyanine (BLUE/GREEN) = 0.05 PARTS

<sup>7</sup>PHthalocyanine GREEN (GREEN) = 0.05 PARTS

*Fig. 8*

09976346 042502

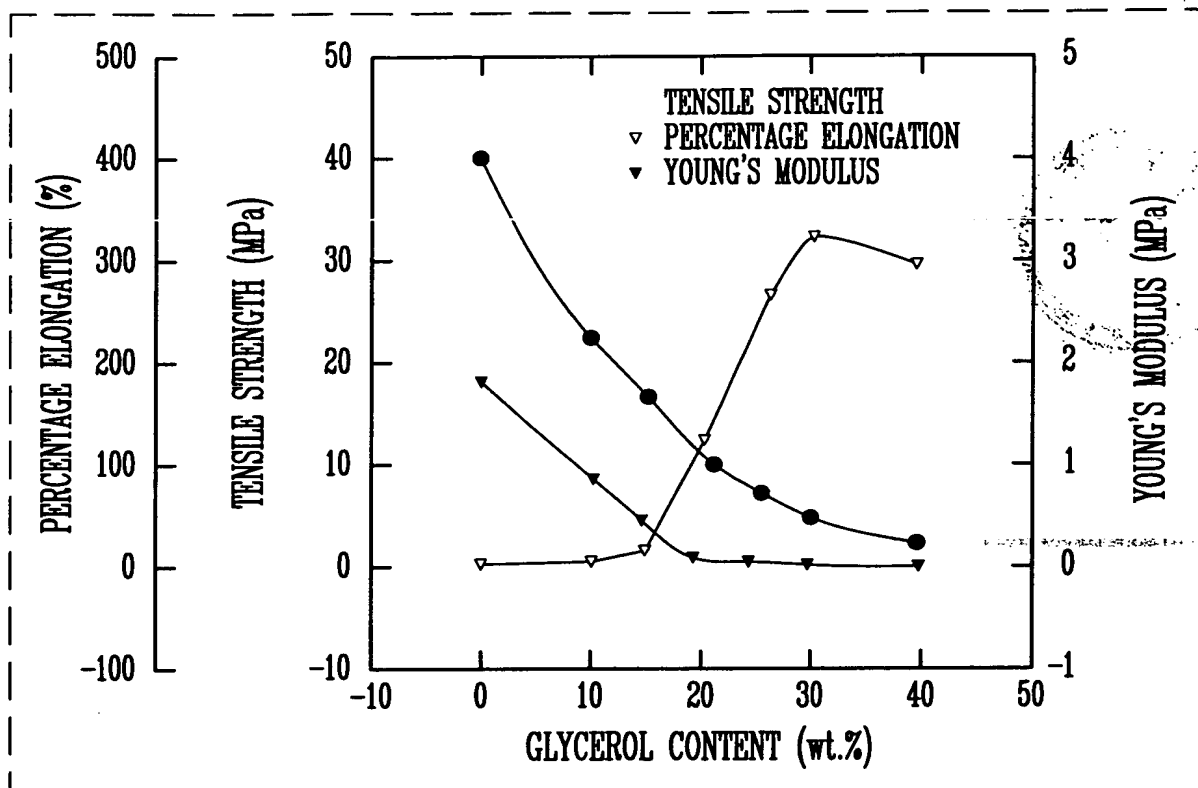


Fig. 9

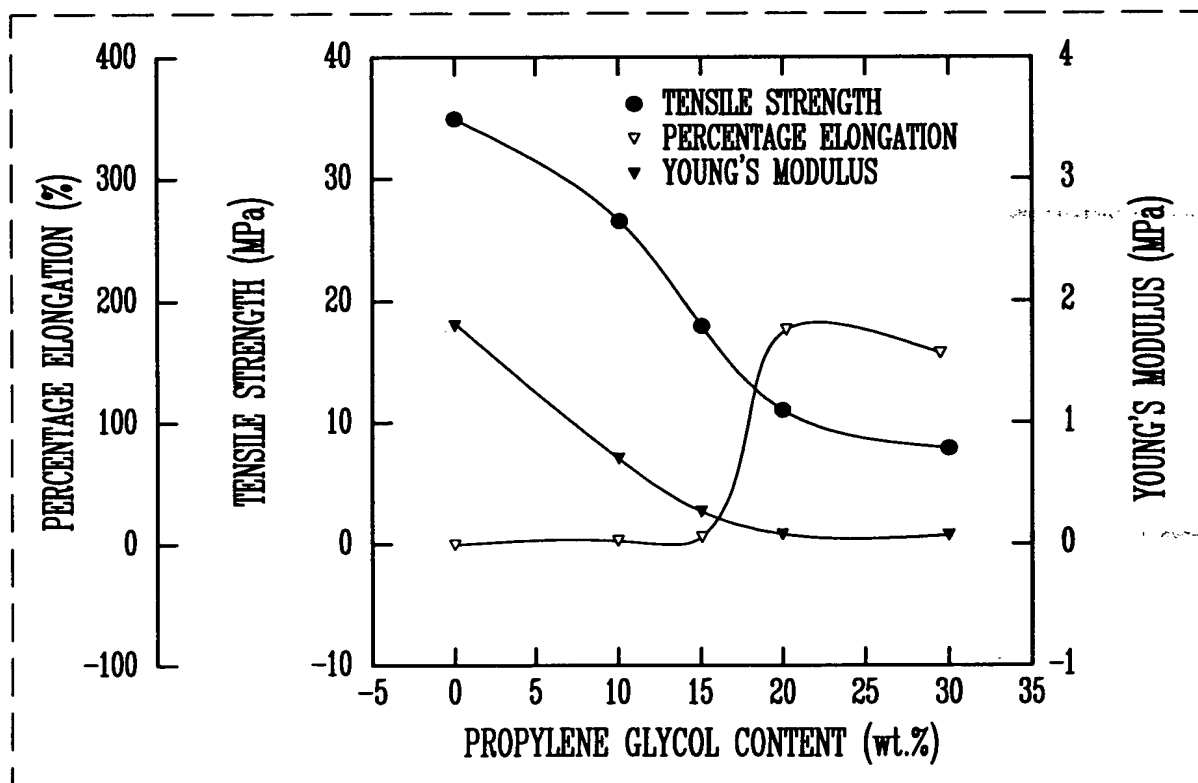
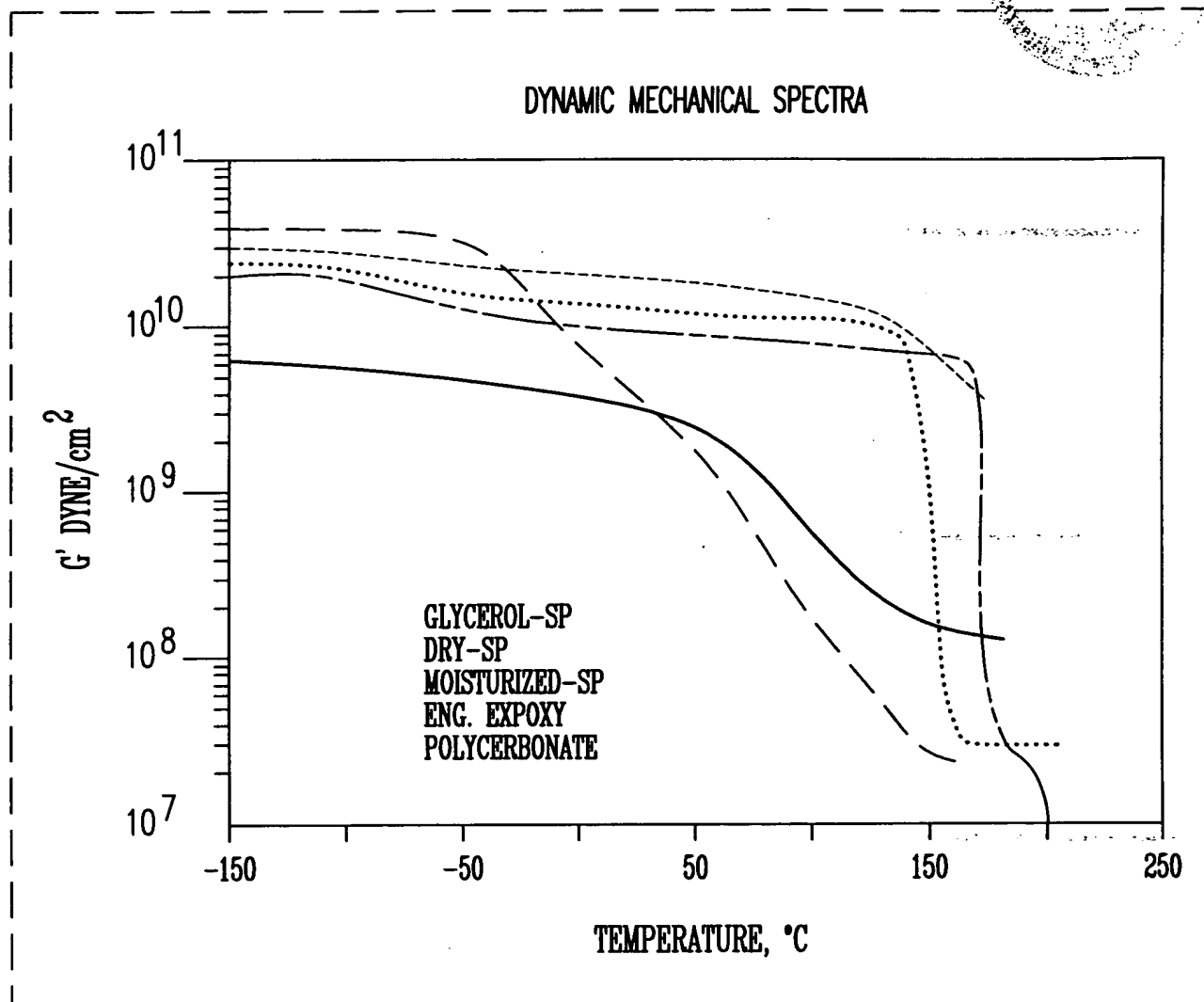


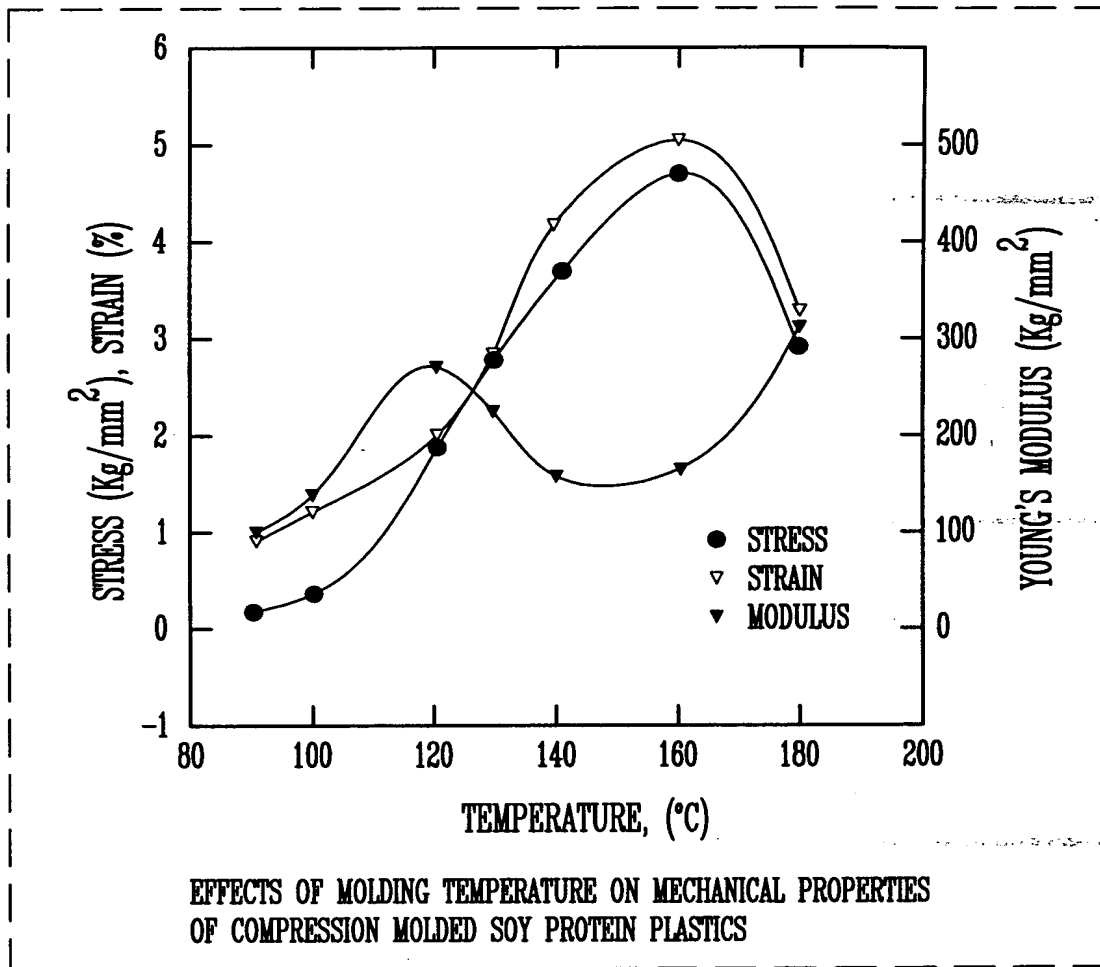
Fig. 10

205240 94E9/660

BY	CLASS	SUBCLASS
DRAFTSMAN		

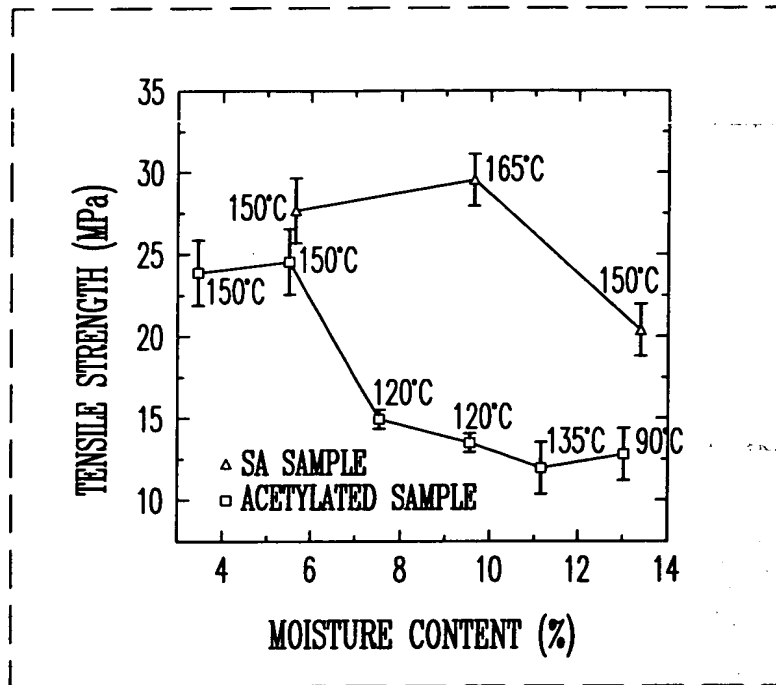


*Fig. 11*

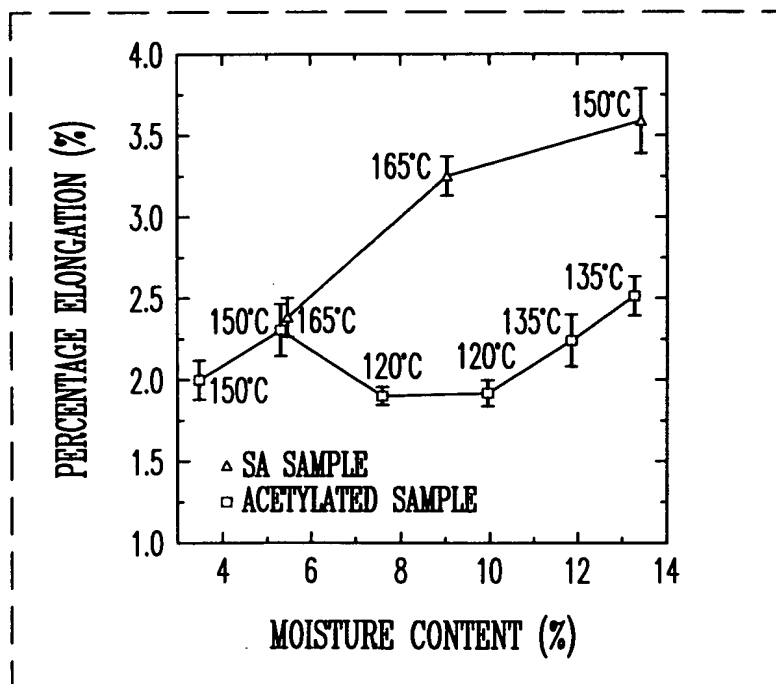


*Fig. 12*



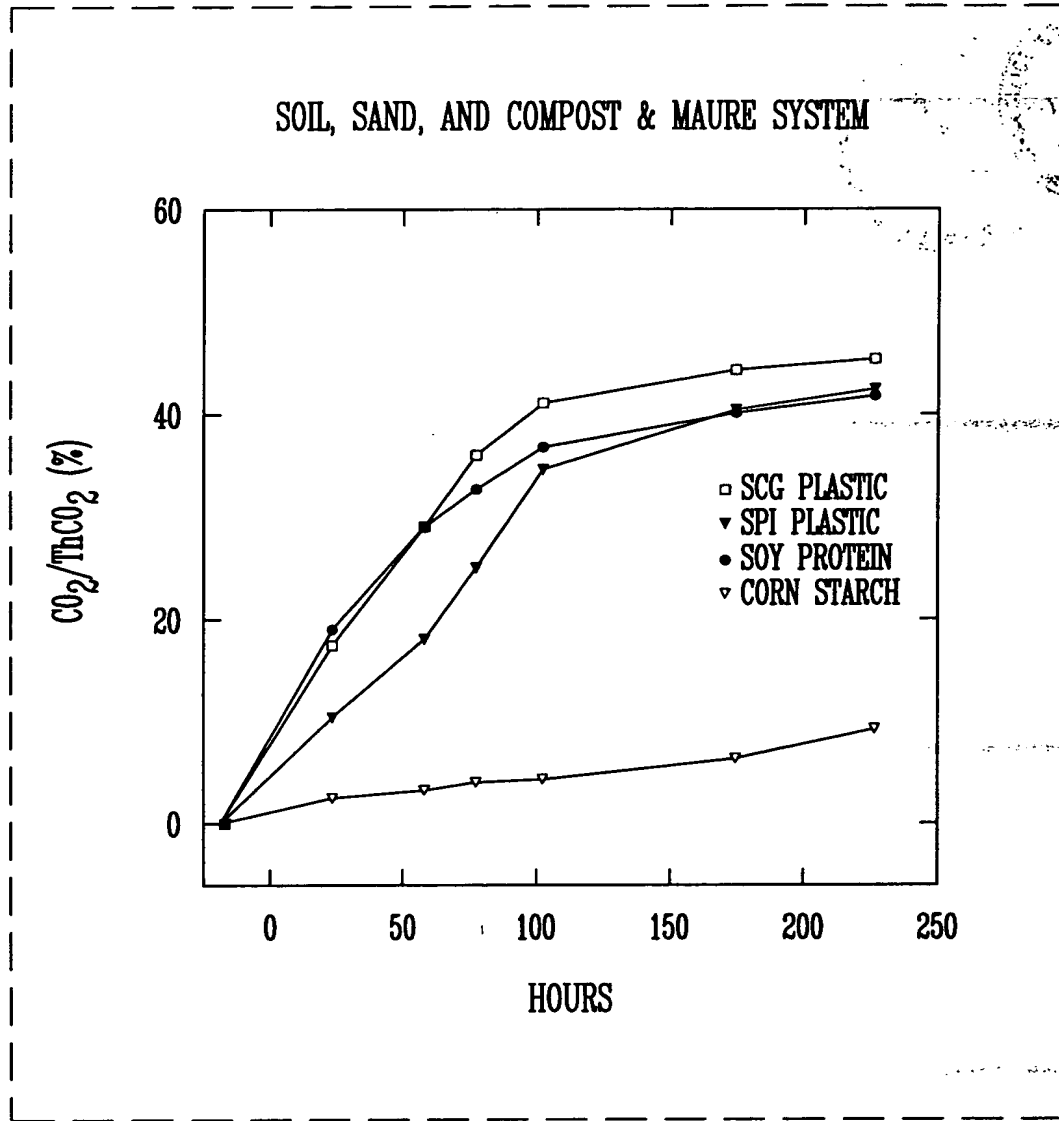


*Fig. 13A*



*Fig. 13B*

09376346, 042502



*Fig. 14*